Exit Presentation

Rachael Humberg

Aerodynamics Branch

OUTLINE

About me

SOFIA

Acoustic Equipment Testing

Acoustic Test Planning

- X- 48B

- Ikhana

Other Fun Things

Acknowledgements

Spring USRP Intern

Mentors

- Steve Cumming
- Ed Haering

Everett Community College

- Sophomore in Aerospace Engineering
- Expected transfer Fall 2009
  - University of Washington
- Expected graduation Spring 2011

SOFIA

Stratospheric Observatory For Infrared Astronomy

Highly modified 747SP

2.5 meter infrared telescope

Joint program by NASA and Deutsches Zentrum fur Luft- und Raumfahrt (DLR)

SOFIA

My Tasks

- Analyze tufting videos
- Compile data on
  - Mach number
  - Dynamic pressure
  - Angle of attack (AOA)
  - Angle of sideslip (AOS)
  - Pressure altitude
- Digitize graphs from Boeing 747SP aeromodel report

SOFIA

Purpose of Work

Tufting Videos

- Previously no good tufting data of original 747
- Create baseline model of flow behavior with door closed
- Allows for observations of changes during open door flight

Digitizing Graphs

- Current simulator of 747SP not very good
- Create tables from original Boeing data for the 747
- Allows for comparison to simulator

SOFIA (port)

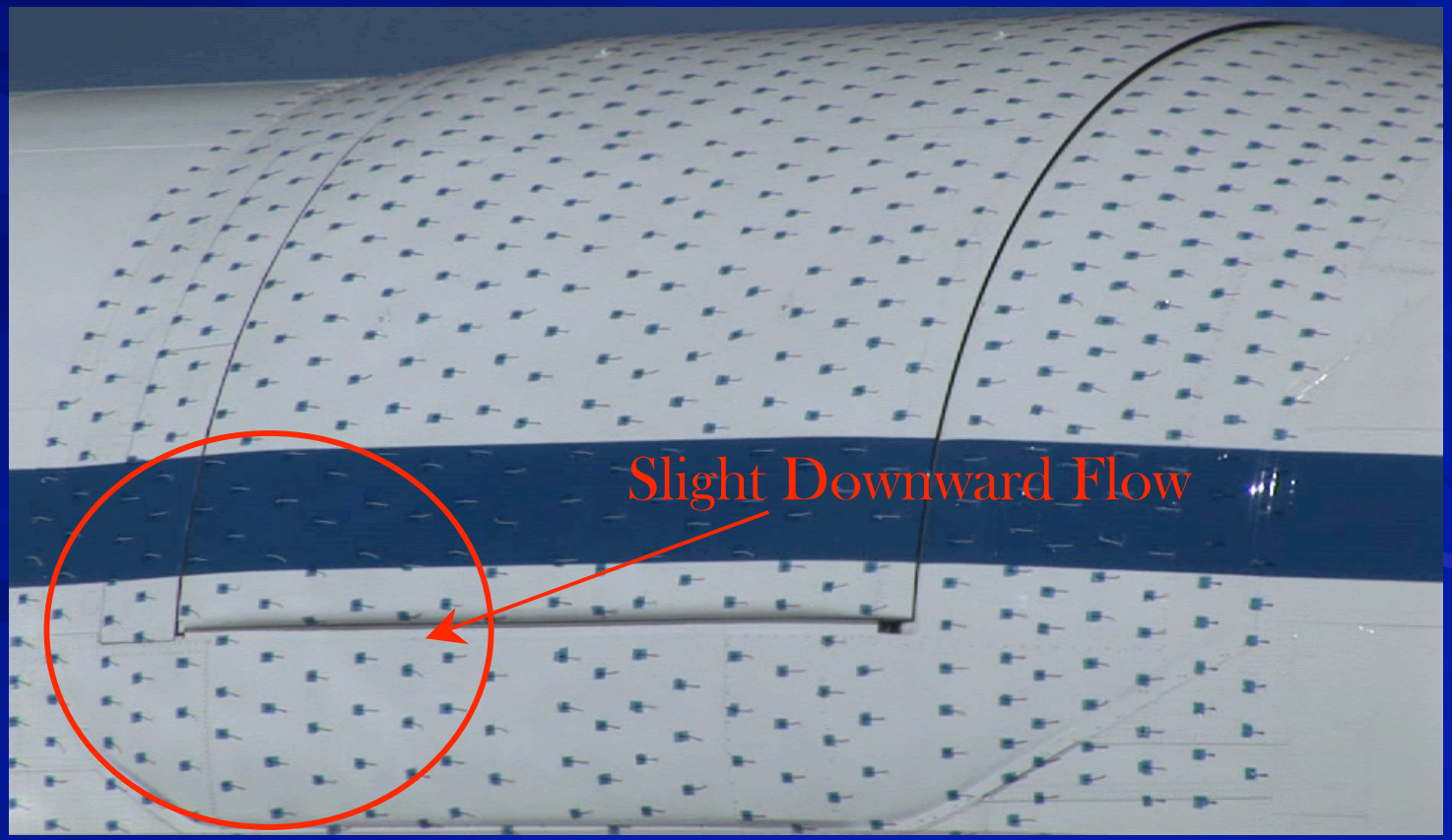
Flight 7, 18:06:01

Altitude: 35,000 ft

Mach number: 0.84

Angle of attack: 3.1 deg

F L O W



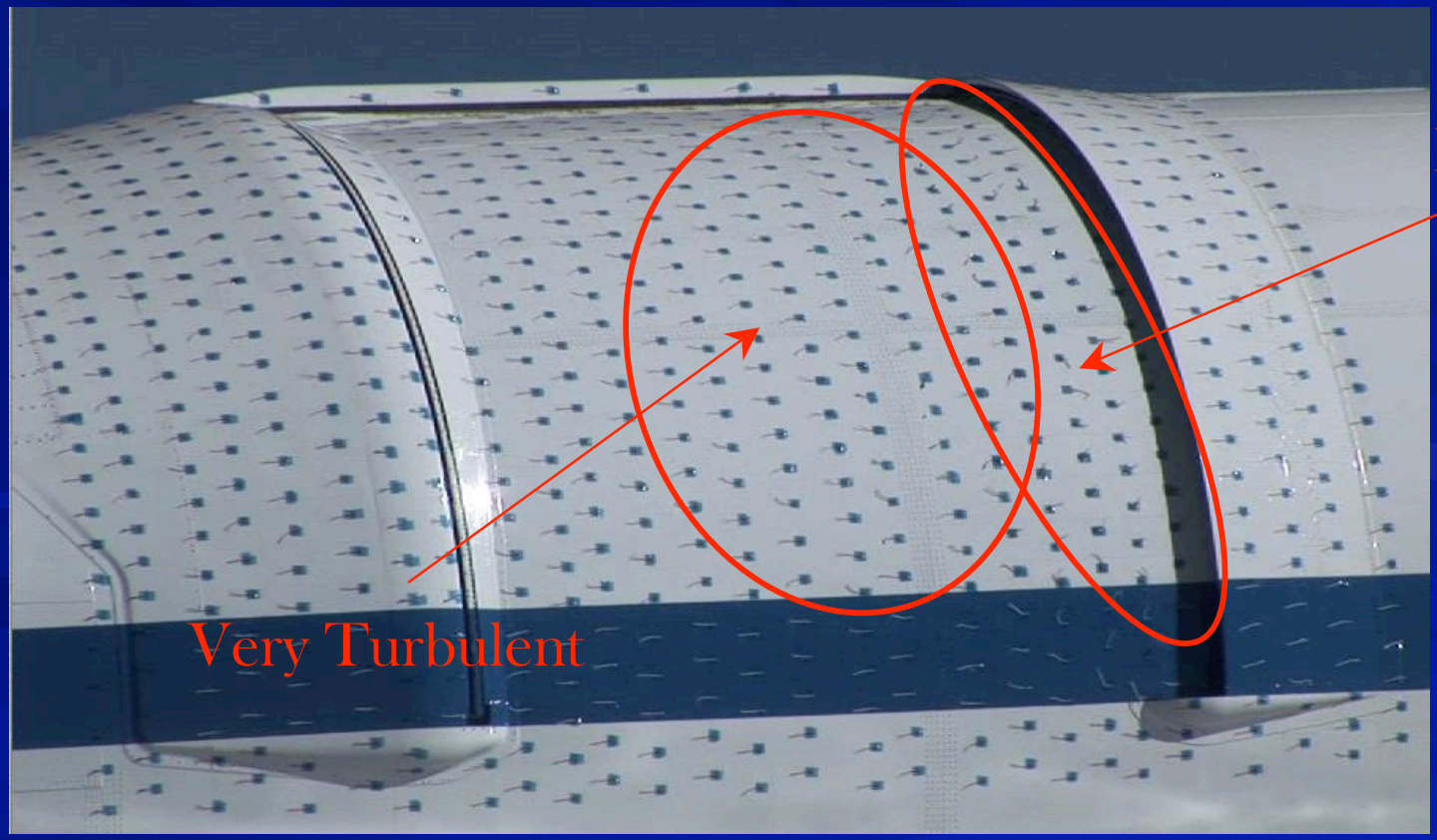
SOFIA (starboard)

Flight 7, 17:34:29

Altitude: 33,000 ft

Mach number: 0.86

Angle of attack: 2.5 deg

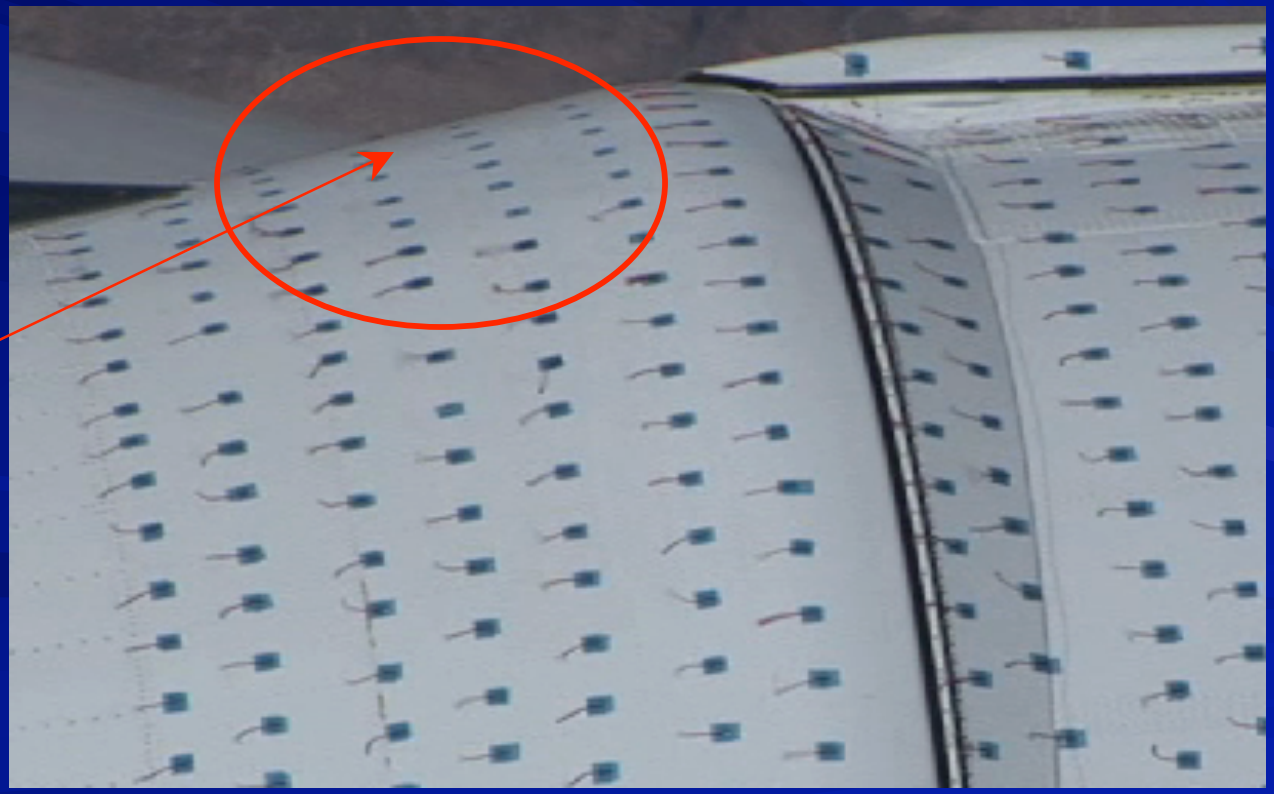


SOFIA (starboard)

Flight 6, 20:32:33

Low turbulence but strong flow on top of aft fairing

Missing Tufts

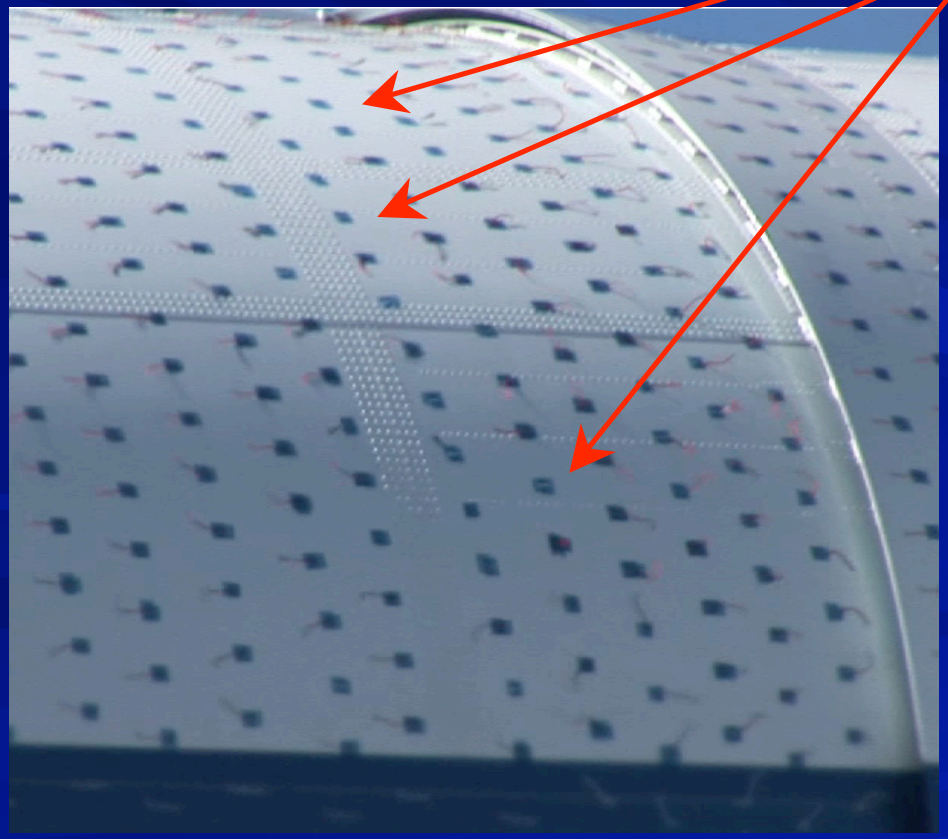


F L O W

SOFIA (starboard)

Flight 7, 21:01:42

Missing tufts



F
L
O
W

Very unsteady flow at separation

SOFIA

Write Matlab script to read data files and graph

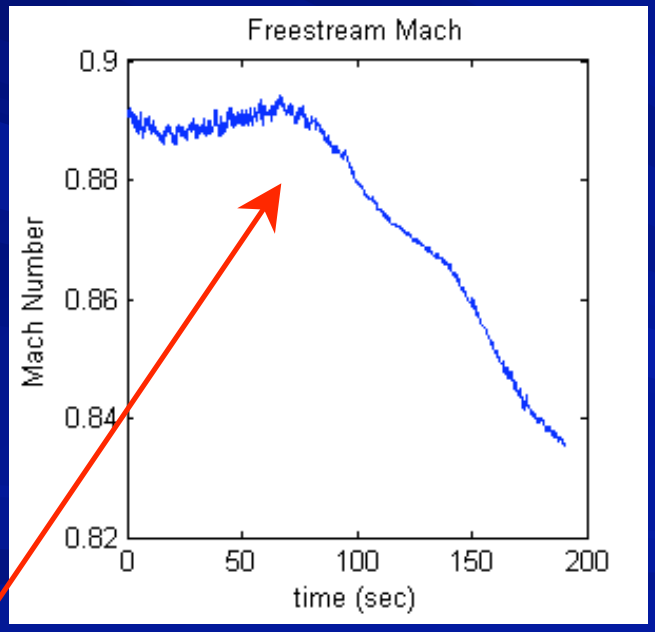
-Mach number

-Dynamic pressure

-AOA

-AOS

-Altitude



Significant change in data

Analyze Graph

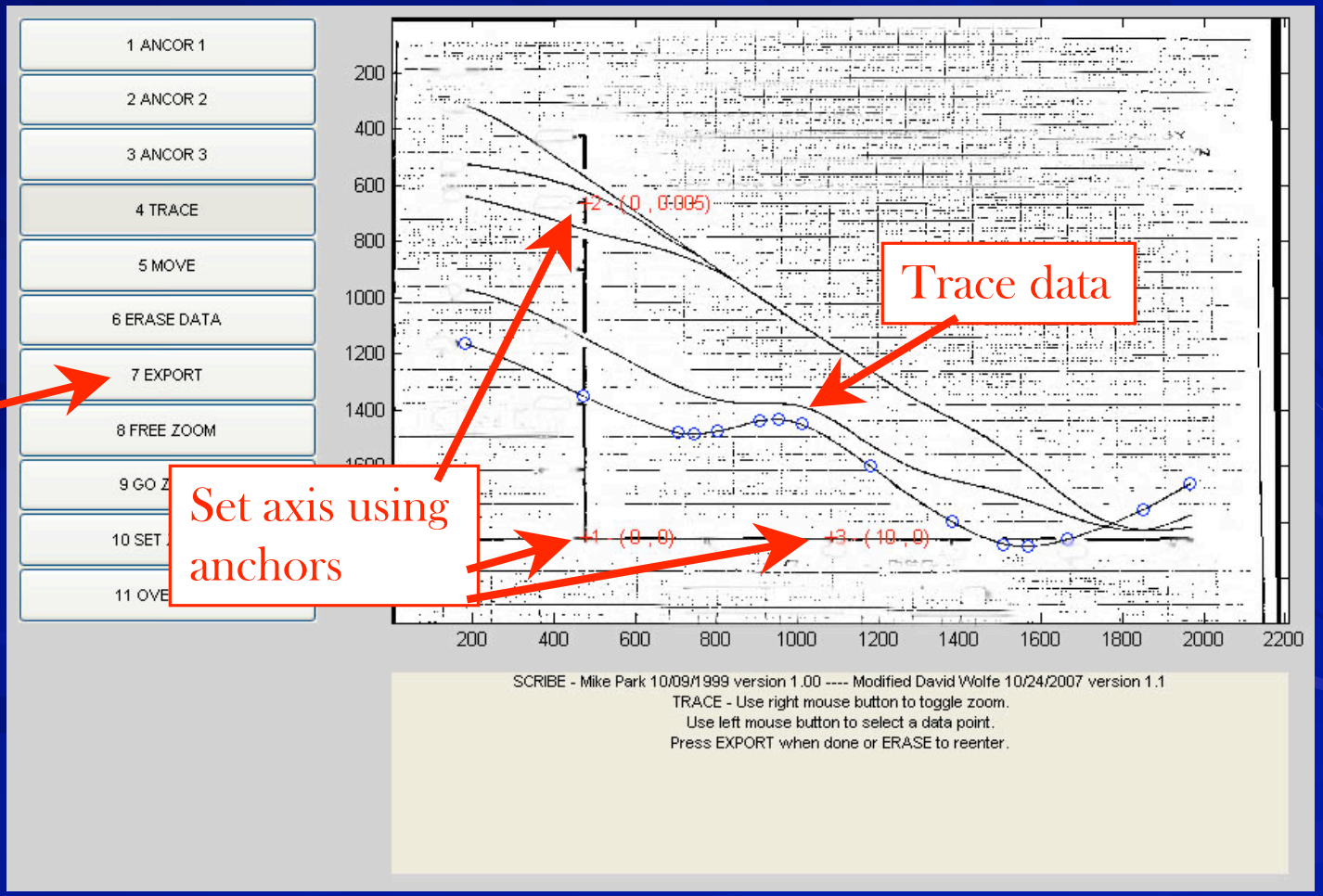
Large change in value
- Review video/ check effect on tufts

Change affects tufts
- Comment on effect

No effect on tufts
- Take average value

SOFIA

Used Matlab GUI to digitize Boeing 747SP aeromodel graphs



Export data to Matlab

Summary

Port side flow seems to be steady

Reverse flow on starboard side after step in fuselage

Turbulence caused by step on starboard side

Baseline data compiled for closed door flight

Equipment Testing

Focus II (signal analyzer)

Takes in continuous analog data

Converts data to digital segments at up to 96,000 Hz

Sends data to PC

Data recorded in RTPro

Equipment Testing

My Tasks

Synchronize 24 signals from 2 Focus II units

Use Matlab to analyze

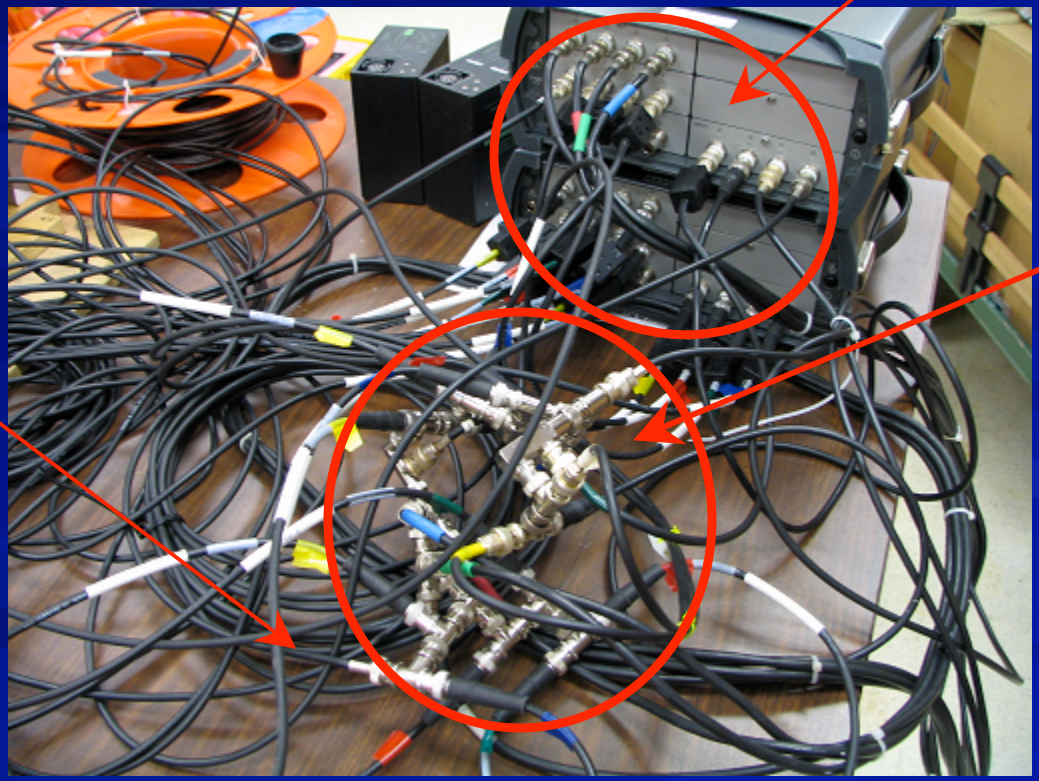
Single GPS pulse transmitted to 24 inputs of Focus II

Focus outputs to USB port

Equipment Testing

MEDUSDA

24 inputs



GPS cable

Mass of ‘T’ and ‘F’ connectors

Acoustic Testing

Background Research

Extensive research in FAR part 36

FAA requirements for subsonic acoustic testing

- Weather
- Testing environment
- Equipment
- Equipment Setup

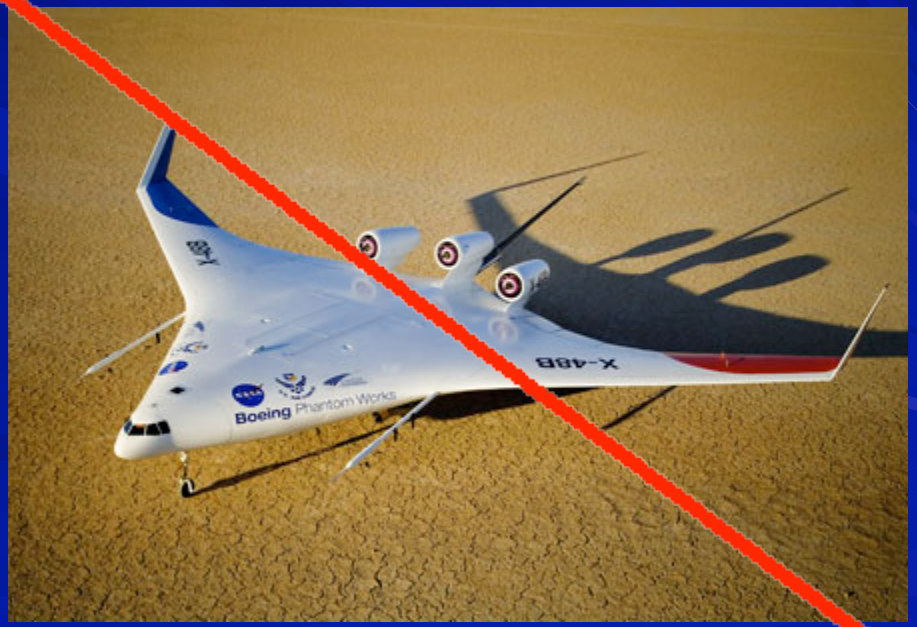
Acoustic Testing: X- 48B

Write up microphone array map to test:

- Take Off Noise
- Landing Noise
- Flyover Noise

Problems:

- Scale Model
- Unmanned Aerial Vehicle (UAV) flight restrictions



Acoustic Testing: IKHANA

My Tasks

- Write up microphone array test plan
- Plot Ikhana GPS data to determine flight path
- Additional background research in FAR part 36

Acoustic Testing: IKHANA

Working with NASA Glenn

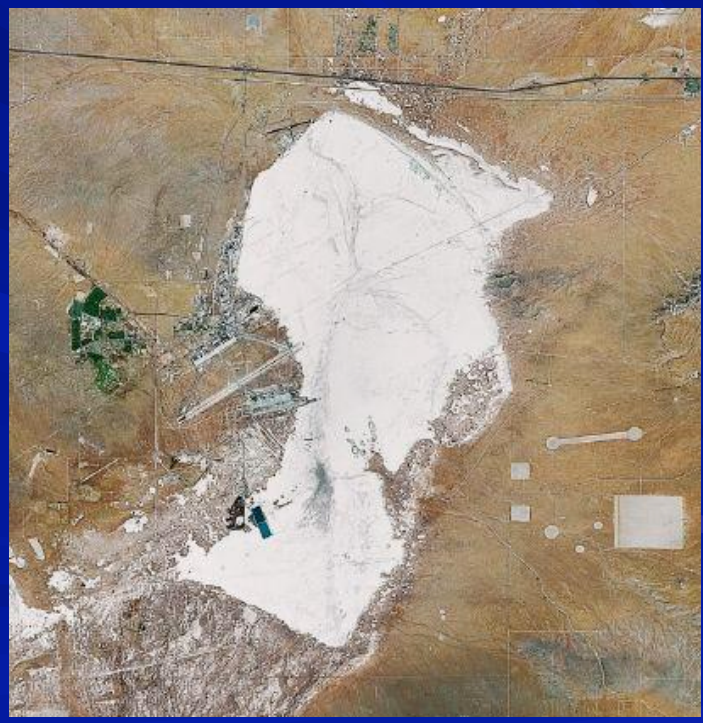
Testing Requirements

- Aircraft must pass over microphone array at around 500 ft using both 3 and 4 bladed propeller

- (possibly less noise with 4 bladed prop)

- Maximum wind velocity: 10 kts

- Terrain must be relatively flat



Lakebed for test

Night Flights

Lessons Learned

Projects change

Schedule always slips to the right

Look at results to verify that they make sense

Ask a lot of questions

3 months is not long enough

Other Fun Stuff!!

Flying

Van Nuys

Hot Springs

JPL Tour

Flying F-18 sim

Poppies

IFCS flights

LA

Motorcycle Rides

Hollywood

The Beach

O-Club

Acknowledgements

Steve Cumming

Ed Haering

Jennifer Cole

Aero Branch

Other Spring Students

Katherine Doran

Isabel Lugo

Miriam Rodon

Shari Olson

USRP

NASA Dryden

¿?¿Questions?¿?